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Developing apprentice skills for innovation through interdisciplinary training and education

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Abstract: This paper is concerned with training students of vocational education programs; specifically, tradesmen and skilled workers to better utilise value networks and knowledge hubs, set up through government initiatives, as an innovation platform. The study indicates that massively interdisciplinary innovation workshops originally designed for university students can be adapted to vocational programs demonstrating similar effects on this demographic. Collaboration around solving real-world problems across various trades and even academic disciplines seems to influence participants’ attitude towards not only interdisciplinary collaboration but also entrepreneurship in general. The study is based on two years of experimentation running six independent workshops across ten different disciplines and trades and four educational institutions.

Keywords: Innovation skills; education; interdisciplinary training; vocational education; apprentice

1 Area of interest, background and research question

In response to the OECD innovation report (2010), the Danish government published an innovation strategy proposing several focus points to increase innovation (The Danish Government 2012, p.8). Among others, the Danish strategy focuses on increased collaboration between enterprises, while tasking educational institutions to produce students with, what is referred to as, increased *innovation capacity*.

This studies area of interest is developing and testing various methods of teaching innovation skills, viewed as building innovation capacity, inside the Danish educational system, that also simulates the desired collaboration dynamic. Specifically, with regards to students currently engaged in vocational education programs coupled with apprenticeship to become tradesmen or skilled workers.

The reason for this specific focus is, that currently almost 80 per cent of enterprises in Denmark fall into the EU’s micro or sub-micro category; a substantial group of which are comprised of skilled workers or tradesmen (Statistics Denmark 2014).

Moreover, many of these companies already choose to, or see a clear need to, engage in, and collaborate through, various value networks in an attempt to remain competitive, participate in larger projects and access broader markets.

However, although the Danish government has created several initiatives to ensure a well-developed and accessible business ecosystem as part of its innovation strategy (Ministeriet for Forskning Innovation og Videregående Uddannelser 2013, p.5) preliminary interviews with randomly selected sub-micro enterprises seem to indicate that many do not feel the value they gain from these networks in any way corresponds to the amount of time and effort they invest in them. This could lead to a gradual decline in the use of said networks devaluating their appeal even more.

The sentiment was particularly evident among skilled workers and tradesmen, who are educated through vocational programs which interchange school-based education and apprenticeship in the so-called sandwich model¹.

The working hypothesis for this study is, that business owners who have undergone vocational education, simply lack training and experience in networked business practices, and therefore that teaching *innovation skills* in this case could be a matter of teaching them to use these resources effectively.

Most vocational programs focusing on skilled trades do not teach any form of business skills despite the fact that many students from these professions are well represented as small business entrepreneurs. They almost exclusively focus on their own trade and seldom on collaboration or interdisciplinary projects; despite many tradesmen later gaining employment on larger projects involving close collaboration between trades.

In contrast, students with an academic background seem more used to strategic planning, identifying skills or knowledge they require but do not possess themselves, seeking out ways to attain them or collaborating with those who already have them.

Moreover, academic students seem more naturally inclined to use the knowledge hubs around them since these are mostly comprised of academic educational and research institutions with which they already have experience through their own education.

The point of departure for this study is the question of how to change this dynamic among vocational students; particularly, in a region of Denmark that already has a well-developed, government financed, business ecosystem specifically designed to support value networks along with potential knowledge hubs (The Danish Government 2012, pp.20–24) in the form of two institutions of higher education and several others offering vocational programs.

This leads to the following research question investigated in this study:

How can we design vocational training modules, which develop the mind- and skillsets necessary to effectively use networks as an innovation and collaboration platform?

This question is broken into two parts. Firstly, delivering practical training of interdisciplinary, problem-based work processes and thereby developing relevant interpersonal, communicative skills along with a basic understanding of development processes involved. Secondly, by attempting to bridge the gap between vocational education and academic education in the hopes that this will facilitate better use of knowledge hubs among trades with little or no prior connection to academic institutions that form these hubs.

The primary approach is to emulate university modules with similar goals, since preliminary enquiries indicated that university students were better equipped for networked collaboration than their vocational counterparts. For this purpose, two workshops were developed to create an innovative environment in which to simulate

collaborative product development processes; mimicking the (idealised) use of value networks portrayed in the Danish innovation strategy. One workshop would focus solely on collaboration (value networks) and the second would also attempt to bridge the gap between academic and vocational disciplines (knowledge hubs).

2 Framing

The concepts of value networks (Clarysse et al. 2014; Prahalad & Krishnan 2008) & open innovation through cross-pollination (Chesbrough 2010; Kelley & Littman 2008) is well understood and this study does not challenge or expand on it, but rather accepts it as a premise along with the Danish innovation strategy itself. The focus of this study is to examine the output (Pawson & Tilley 1997, pp.63–64), through action research, of specific training methods targeting the attitude towards and use of these types of networks in students currently engaged in some form of vocational education.

Conceptually, the experimental workshops are grounded in practice theory (Reckwitz 2002; Nicolini 2012, pp.78–92) and the idea that *educational praxis* should be based on an analysis of a specific *professional practice*. Thus, that vocational education in particular may need to interpret professional practice differently from trade to trade thereby forming different educational praxis' to fit each one (Haslam & Rosenstand 2015, p.70).

This reasoning lends itself to a much broader discussion of how innovation skills, and by extension innovation capacity, may be defined, which is the subject of a different ongoing studyⁱⁱ related to this one. This paper does not enter this discussion but simply accepts the use of value networks, as specified in the Danish innovation strategy, as a premise.

However, the distinction between professional practice and educational praxis is maintained during evaluation of the workshops since the teaching of skills, and the application of said skills are seen in two fundamentally different contexts driven by different rationales (Haslam & Rosenstand 2015, pp.66–67).

To evaluate output participant questionnaires' and interviews are used to gauge reactions from:

1. External participants representing relevant professional practice
2. Educators participating as facilitators representing education praxis
3. The students themselves representing both education (as students), and profession (as apprentices).

Having run the workshops multiple times allows for output comparison from iteration to iteration, however, no matter the consistency of results it does not allow for conclusions toward outcome; only for comparison with similar initiatives. Attempting to demonstrate causation between arbitrary educational initiatives, and long term behaviour by participants in said initiatives is considered impractical if at all possible. Thus, only process and outcome are evaluated (Krogstrup & Dahler-Larsen 2003, p.75).

3 Experimental interdisciplinary workshops

Two workshops were designed as a platform for action research experimentation. They have each been run and revised three times over the last two years. Both are designed as innovation workshops, both are problem-based and revolve around the general theme *welfare technology* and both are based on highly interdisciplinary group work.

Welfare technology was selected as the general theme for two reasons. Firstly, the realisation of this experiment was made possible through an existing collaboration between two local institutions (SOSU Nordⁱⁱⁱ and Tech College Aalborg) representing health care and technology programs respectively, and secondly because the theme was considered both relatable to all participants and applicable from most educational programs perspectives to some extent.

Both workshops are modelled on existing initiatives designed and run at Aalborg University^{iv} allowing their design to draw on a large body of experience. Since these initiatives were designed specifically for use at university level they could not be used outright, so were adapted in theme, scope and process rigidity to fit the vocational education programs involved. One major difference is, that students participating in the original university workshops generally do so on a voluntary basis whereas students from the vocational programs have no say whatsoever. Participation is mandatory and replaces or supplements existing *innovation theory*^v courses.

The first workshop has a duration of three days and consists solely of participants from vocational education programs; most, but not all, of which are based on the sandwich model of school-based training and apprenticeship. Participants come from as wide a range of fields as possible across two institutions but always include enough from *health service* as well as *technology* to allow for one participant from each field to be in every group. Groups usually have between five and seven participants in total, with approximately fifteen to twenty groups per workshop.

The workshop is run, and the group work facilitated, by educators from the various educational programs represented. However, representatives from local businesses and organisations relevant to the specific workshops theme are invited to give inspirational talks, act as experts and ultimately judge the participants' contributions.

During the workshop students collaborate in groups to identify a specific problem within the theme parameters, develop a solution to this problem that could also be a viable business opportunity and finally pitch their idea to judges in under five minutes. Educators acting as facilitators help students drive the process, often introducing useful tools and methods on an ad hoc basis throughout. Thus, avoiding large blocks of theory or abstract information during the workshop; focus is almost solely on the process.

All groups receive feedback from the judges (who represent the current or relevant business practice) and a selection of the facilitators (who represent the educational praxis); a winner is declared, however, there are no prizes. The workshop is concluded with representatives from relevant local networks introducing themselves and in some cases approaching groups to discuss opportunities for continued work on their ideas.

The second workshop follows the same formula, with two exceptions: the duration is reduced to one (rather long) day, and it also includes participants from the two largest academic institutions in the area (University College North Jutland and Aalborg University). A minimum of one from each institution to participate in every group.

The reason for reducing the duration is mainly logistical since the challenge of coordinating approximately ten different educational programs across four different

institutions made it impractical to maintain a three-day duration. The reason for introducing academic students alongside vocational students is to test if and how this would affect the process dynamic, and at the same time introduce, and hopefully demystify, the concept of collaboration between vocational professions and academic disciplines.

Student feedback

Students were quizzed as to their expectations towards the workshop before participating, and asked to evaluate the workshop by completing a semi-qualitative questionnaire afterwards.

In general terms approximately 60% of vocational students did not see the workshops as at all relevant to their field or consider it at all useful to begin with. Most of this group called it an outright waste of time that should be used to train actual trade skills. The remaining 40% were largely indifferent with only 15% directly expressing a positive interest in the workshop. By contrast, in the final evaluation, almost 90% of the students stated that the workshop was *relevant* to their field and that they though the skills learned would be *very useful* in their work life.

Similarly, the final evaluations show an increased general interest in interdisciplinary projects. Interestingly, almost 80% of the vocational students said they were surprised that they themselves had anything to contribute to the process, and the other participants (students and judges) seemed to value their input.

In spite of the fact, that the actual ideas generated during the workshops are often simplistic and seldom (there are exceptions) particularly original or interesting business propositions, the students are immensely proud of what they have accomplished in such a short time. That they are working on solutions to real problems which real businesses have an interest in, seems to be an important factor towards this.

A rather surprising result is an apparently increased interest in becoming an entrepreneur within professions that typically are not noted for a high degree of entrepreneurship (f.eks. Health Care Assistants who are typically employed in government run facilities). During final evaluation, almost 40% of this group express an interest in becoming an entrepreneur at some point in their life. By contrast none expressed similar interest beforehand; many actually laughed at the idea when the question was put forward.

4 Findings

Data collected during the study consists of Excel spreadsheets containing student evaluations, recorded interviews with facilitators (educators) and various external participants (experts, judges, business and network representatives etc.) together with observational notes made by steering committee members (including this author).

The data shows many of the same tendencies as in the university counterparts they are based on (Østergaard & Rosenstand 2012; Poulsen & Rosenstand 2012) which is also theoretically underpinned within innovation and entrepreneurship education research (Poulsen & Rosenstand 2012; Poulsen & Rosenstand 2009; Smed et al. 2010).

Students from vocational programs are forced to move out of their comfort zones and collaborate with other students from different vocational backgrounds and in some case an array of academic disciplines. While this is the source of much frustration during the

workshop, for the most part it turns out to be a largely positive experience which in turn prompts reflection; both towards the pros and cons of collaborative projects, but also on the students own professional identity and what they have to offer outside their own trade.

The rapid development of confidence among vocational students to contribute to the collective, is one of the most visible results during the workshops and seems to mirror the change in general attitude towards the idea of actively seeking out different perspectives.

5 Discussion

The idea of teaching certain skills by emulating the environments in which they are used as closely as possible is well understood. However, this study attempts to emulate a desired ideal that does not fully exist; while much of the infrastructure necessary is in place the specific demographic targeted is not currently making full use of it.

The workshops in this study emulate a reality based on what appears to work for a different demographic, but does not take into consideration that the infrastructure it seeks to enable may simply be better suited to the demographic that already seems capable of using it.

Even though these workshops have produced results similar to the original academic versions, this does not mean that the participants will be any better suited to utilise the infrastructure in question. It does, however, facilitate a visible and positive change in attitude towards the base concept of interdisciplinary collaboration among the vocational students. It also seems to *soften* the participant attitude towards entrepreneurship; possibly allowing for a broader understanding of what it means to be entrepreneurial. Whether or not this is a lasting effect is beyond the scope of this study. Although, it is worth noting that all six of the workshops held so far have displayed very similar results in this area.

6 Conclusion

This paper unfolds the question: How can we design vocational training modules, which develop the mind- and skillsets necessary to effectively use networks as an innovation and collaboration platform?

The research so far demonstrates that the type of massively interdisciplinary innovation workshops developed for university use can indeed be translated to vocational education to similar effect. Indicating that enabling effective use of value networks and knowledge hubs is a skillset that can be trained, and that these formats are a viable method of doing so.

7 Areas for feedback & development

All suggestions and ideas for further experimentation and development is much appreciated. Comments on methodology are also welcome: Alternatives to action research in the continued research? Methods and approaches regarding long term evaluation on professional practices. Specifically, in regards to demonstrating

effectiveness which is particularly relevant considering the current political discourse on education.

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ⁱ In Danish the term *vekseluddannelse* is used which roughly translates into *alternating education*. However, it is usually referred to as the *sandwich model* in English.

ⁱⁱ The study is a collaboration between this author and Søren Smed from the Invio group at Aalborg University, and is concerned with developing a design-based model for working with innovation processes. It is expected to be published by late 2016.

ⁱⁱⁱ Social og sundhedsuddannelserne Nordjylland (SOSU Nord)

^{iv} Workshop for Innovation and Entrepreneurship – WOFIE (wofie.aau.dk/) and User-Driven Creative Academy - U-CrAC (ucrac.dk/) formed the inspiration and model for the basic format of the experimental workshops.

^v Depending on the vocational or academic program the students are enrolled in, the specific course supplemented or replaced by workshop participation varies. However, all of the participating programs curriculum so far have included at least one course covering innovation that made it easily compatible.